BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 415 562 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **90308364.0**

(22) Date of filing: **30.07.90**

(51) Int. Cl.5: **H01J 29/48**, H01J 29/82, H01J 9/18

(30) Priority: **31.08.89 US 401208**

(43) Date of publication of application:
06.03.91 Bulletin 91/10

(84) Designated Contracting States:
DE FR GB NL

(71) Applicant: **TEKTRONIX, INC.**
P.O. Box 500 (50-PAT)
Beaverton Oregon 97077-0001(US)

(72) Inventor: **Askew, Dennis D.**
437 SE 15th Gresham
OR 97080(US)
Inventor: **Bomberger, Donald C.**
22555 S.W. Boones Ferry Road
Tualatin OR 97062(US)
Inventor: **Odenthal, Conrad J.**
1308 SE 76th Avenue
Portland, Oregon 97215(US)

(74) Representative: **Lawrence, Malcolm Graham et al**
Hepworth, Lawrence, Bryer & Bizley Gate House South West Gate
Harlow Essex CM20 1JN(GB)

(54) Grid assemblies for use in cathode ray tube.

(57) An integrated grid (G1/G2) assembly having enhanced mechanical strength and rigidity is provided for use in an electron gun assembly of a cathode ray tube (CRT). In the integrated grid assembly, the first and second grids (35 and 40, respectively) are fixed in relationship to one another, both axially and radially, by means of an insulating element (50) and a collar element (55). Brazed joints are preferably provided at the interface of the insulating element (50) with the second grid (40) and the collar element (55) to enhance the mechanical strength and rigidity of the assembly. An integrated grid (G1/G2)/anode assembly may be provided by mounting anode assembly (45) fixedly with respect to second grid (40) by means of second insulating element (60) and second collar element (6?). Methods for assembling the integrated grid assemblies are also disclosed.

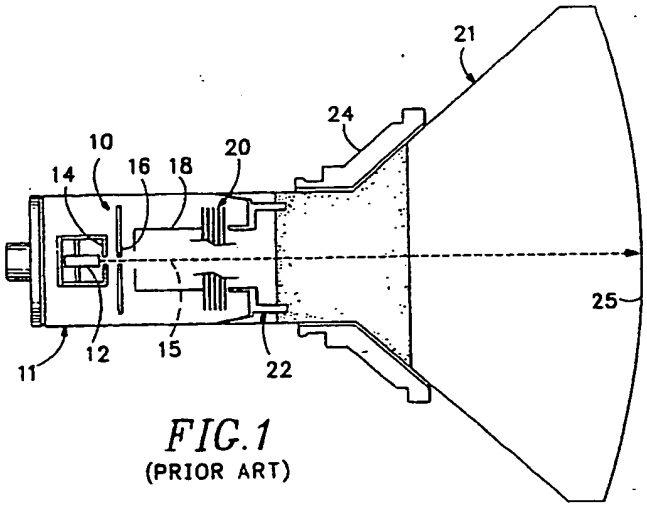

FIG.1
(PRIOR ART)

EP 0 415 562 A2

GRID ASSEMBLIES FOR USE IN CATHODE RAY TUBES

The present invention relates generally to methods and apparatus for providing cathode ray tube (CRT) display images having increased intensity and resolution by reducing deflection and distortion of the electron beam in the electron gun assembly of the CRT.

Fig. 1 schematically illustrates a magnetically deflected cathode ray tube (CRT) of a type which is known in the art. The CRT generally comprises a funnel-shaped portion 21 which terminates in phosphor screen 25, and a cylindrical neck portion 11 housing electron gun apparatus 10. Electron gun apparatus 10 generates and focuses an electron beam to produce a luminous image on the phosphor screen. Cathode 12 emits a stream of electrons forming. electron beam 15, which successively passes through apertures in first grid 14 and second grid 16. Thereafter, the electron beam passes through an aperture at one end of anode cylinder 18, and it typically traverses a series of beam focusing and/or correction members 20. For example, a series of wafer electrodes may be provided to correct astigmatism produced by non-uniformities in the electromagnetic deflection field, as taught in U.S. Patent 4,672,276. Electron beam 15 subsequently traverses focus electrode 22 and magnetic deflection yoke 24 and finally impinges on and illuminates the phosphor screen. An important objective in many CRT applications is to generate an electron beam providing a high intensity, sharply focused illuminated spot over the entire CRT screen. To achieve this objective, the electron beam must traverse the electron gun and funneling portion of the CRT without deviating from the desired beam path.

The present invention is directed to the electron gun portion of the CRT apparatus. First and second grids 14 and 16, respectively, have voltages applied thereto. Changes in the voltages applied to the cathode and the first grid with respect to one another vary the magnitude of electron emissions, and thereby vary the intensity of illumination on the phosphor screen. The voltage applied to second grid 16 determines the cathode voltage at which electrons are emitted. Precise repeatable spacing between the cathode, the first grid and the second grid, and precise alignment of apertures in the first and second grids are critical factors. Small misalignments of the first and second grids result in significant distortion of the electron beam from its desired beam path axis. For example, a misalignment of the first and second grid apertures of 0.5 mil (.0005 inch) produces a 30% axial misalignment of the beam from its desired beam path axis at the limiting aperture and focus assembly of a high resolution electron gun. Beam misalignment and distortion of this type typically results in "banding", which is manifested by the formation of bright lines at intervals in the rastered portion of the CRT screen. Banding reduces the clarity and resolution of a CRT display.

Fig. 2 illustrates conventional prior art first grid (G1)/second grid (G2) assembly. Cathode assembly 30 comprises cathode sleeve 31 having cathode cap 32 mounted at one end, and cathode 33 at the terminal end thereof providing emission of the electron beam. Cathode assembly 30 is rigidly mounted in non-conductive cathode support member 34 and provided with the necessary support means and electrical connections, as is well known in the art. First grid (G1) assembly 35 comprises a generally flat grid layer 36 with central aperture 37 and grid cap 38 extending generally at a right angle from the periphery of flat grid layer 36. A spacer 39 is preferably provided to locate the cathode assembly with respect to the first grid assembly in the axial and radial directions.

Second grid (G2) 40 is generally flat and has central aperture 41 provided therein and aligned with aperture 37. Second grid 40 is arranged parallel to and spaced a distance from first grid (G1). The anode assembly, which has a surface arranged parallel to and spaced apart from second grid (G2) and a central aperture aligned with apertures 37 and 41 is not shown. As electron beam 15 is emitted from cathode 33 and traverses the multiple grid and anode apertures during operation of the electron gun and CRT, it is important that the apertures in the grid and anode assemblies are properly aligned to assure that the electron beam is not deflected from its predetermined, calculated path.

In conventional, prior art electrode gun assemblies, first and second grids (G1 and G2) are fixed in relationship to one another by means of support pins 42 mounted in glass rods 44, as shown in Fig. 2. A plurality of glass rods 44 (generally four) having support pins bonded therein are generally arranged radially around the periphery of the G1 cap. This arrangement serves to space the grids from one another at the desired axial spacing and to align the grids radially with respect to one another. Glass rods 44 are typically heated, and support pins 42 mounted on both grids are embedded therein while the glass is softened by heating. The G1/G2 assembly is cooled, and central apertures 37 and 41 are subsequently provided in both grids G1 and G2, typically by EDM (electron discharge machine), so that the grid apertures are precisely aligned. The cathode assembly is thereafter moun-

ted in the first grid (G1) assembly. The anode assembly is similarly mounted on a plurality of radially arranged glass rod supports which typically extend substantially the length of the electron gun assembly and provide structural support for many of the electron gun components.

Misalignment of the first (G1) and second (G2) grid apertures 37 and 41, respectively, generally occurs because the grid (G1/G2) assembly shown in Fig. 2 lacks mechanical strength and rigidity. During mounting of support pins 42 in glass rods 44, the glass rods are softened by flame heating to permit embedment. As the assembly is cooled, the metallic support pins and glass rods have different coefficients of thermal expansion, and the metallic support pins contract more than the surrounding glass surface. The support pins become trapped rather than bonded in the glass rods. The grid (G1/G2) assembly therefore does not exhibit good mechanical strength, and movement of the first and second grids relative to one another may occur during and/or after provision of the grid apertures. Movement of the first and second grids relative to one another frequently occurs during mounting of the cathode assembly, which creates substantial misalignments of the grid apertures.

Accordingly, it is an objective of the present invention to provide a grid (G1/G2) assembly which is characterized by mechanical strength and rigidity.

It is another objective of the present invention to provide a grid (G1/G2) assembly in which the grid apertures remain accurately and precisely aligned during assembly and operation of the electron gun and CRT.

It is yet another objective of the present invention to provide methods for reducing deviation and distortion of the electron beam in the electron gun assembly of the CRT.

Disclosure of the Invention

The present invention provides an integrated grid (G1/G2) assembly which demonstrates significantly improved mechanical strength and rigidity. Enhanced mechanical strength and rigidity of the grid (G1/G2) assembly aids in maintaining accurate and precise alignment of the grid.

The metallic pin and glass rod support system described above with reference to prior art devices and methods is replaced with a non-conductive insulating element and a support collar. The insulating element is mounted, preferably by brazing, on the second grid (G2). The support collar has generally perpendicularly oriented flanges, and one flange is mounted to the outer surface of the first grid (G1) cap. The other flange is mounted, preferably by brazing, to the insulating element to provide a rigid, unitary G1/G2 assembly. The coefficients of thermal expansion of the insulating element, the support collar, and the second (G2) grid are preferably approximately matched so that as the grid assembly is cooled after brazing, all of the support surfaces are in intimate contact to enhance mechanical bonding. The grid apertures are preferably drilled after assembly of the integrated G1/G2 assembly.

According to another aspect of the present invention, a similar type of support arrangement may be employed to mount the anode assembly to the grid (G1/G2) assembly. A second insulating element is mounted, preferably by brazing, on the G2 surface. One flange of a support collar having generally perpendicular flanges is mounted, to the surface of the anode cup, and the other flange is mounted, preferably by brazing, to the insulating element. This provides a unitary grid (G1/G2)-/anode structure which demonstrates superior mechanical strength and rigidity. Apertures in the grids and anode may be provided after mounting the components to form an integrated assembly to provide accurately and precisely aligned apertures.

Brief Description of the Drawings

Fig. 1 is a schematic longitudinal cross-sectional representation of a magnetically deflected cathode ray tube (CRT) of the type for which the grid assemblies of the present invention are suitable;

Fig. 2 illustrates a prior art grid (G1/G2) assembly intended for use in the electron gun of a CRT apparatus;

Fig. 3 illustrates a unitary grid (G1/G2) assembly according to the present invention suitable for use in the electron gun of a CRT apparatus;

Fig. 4 shows a plan view of a non-conductive insulating element according to the present invention;

Fig. 5 shows a side view of the insulating element of Fig. 4; and

Fig. 6 illustrates an integrated grid (G1/G2)-/anode assembly according to the present invention.

Description of Preferred Embodiments

Fig. 3 illustrates a grid (G1/G2) assembly suitable for use in the electron gun portion of CRTs according to the present invention. Cathode assembly 30 comprises cathode sleeve 31 having cathode cap 32 mounted at one nd thereof, and cathode 33 at the terminal end thereof comprising an electron-emissive coating, e.g. a mixture of

second faces oriented parallel to one another, said first face being rigidly mounted on said grid surface of said second grid (40); and

(ii) a collar element (55) comprising first and second flanges (54, 53) oriented substantially perpendicular to one another, said first flange (54) rigidly mounted on said second face of said insulating element (50) and said second flange (53) being rigidly mounted to said cap portion (38) of said first grid (35).

2. A grid assembly as claimed in Claim 1, wherein said grid layer (36) of said first grid (35) and said grid surface of said second grid (40) have aligned apertures (37, 41) penetrating a central portion thereof.

3. A grid assembly as claimed in Claim 1 or Claim 2 wherein said grid layer (36) of said first grid (35) is round, and wherein said cap portion (38) of said first grid (35) and said first and second flanges (54, 53) of said collar element (55) are annular.

4. A grid assembly as claimed in any one of Claims 1 to 3 wherein said insulating element (50) is annular.

5. A grid assembly as claimed in any preceding claim wherein said first face of said insulating element (50) has a slot (51) formed therein, said slot (51) having a depth slightly larger than the distance between said grid layer (36) of said first grid (35) and said grid surface of said second grid (40).

6. A grid assembly as claimed in any preceding claim wherein said first face of said insulating element (50) is rigidly mounted on said grid surface of said second grid (40) by brazing.

7. A grid assembly as claimed in any preceding claim wherein said first flange (54) of said collar element (55) is rigidly mounted on said second face of said insulating element (50) by brazing.

8. A grid assembly as claimed in any preceding claim wherein said second flange (53) of said collar element (55) is rigidly mounted to said cap portion (38) of said first grid (35) by welding.

9. A grid assembly as claimed in any preceding claim wherein said collar element (55) and said insulating element (50) comprise a materials having similar coefficients of thermal expansion one to another.

10. A grid assembly as claimed in any preceding claim wherein said collar element (55) comprises a metallic material and said insulating element (50) comprises a ceramic material.

11. A grid assembly as claimed in any preceding claim wherein said collar element (55) and said first and second grids (35, 40) comprise a nickel-cobalt-iron alloy and said insulating element (50) comprises alumina.

12. A grid assembly as claimed in any preceding claim and including a cathode (30) mounted within said first grid (35) and positioned along a generally central longitudinal axis thereof.

13. A grid assembly as claimed in any preceding claim and including a second insulating element (60) having first and second faces oriented parallel to one another, said first face being rigidly mounted on a grid surface of said second grid (40); a second collar element (65) comprising first and second flanges oriented substantially perpendicular to one another, said first flange (64) being rigidly mounted on said second face of said second insulating element (60); and an anode (45) having a grid layer (46) and a cap portion (48) extending substantially perpendicularly from the periphery of said grid layer (46), said cap portion (48) of said anode (45) being rigidly mounted on said second flange (63) of said second collar element (65).

14. A method for mounting a plurality of grids to form a grid assembly for use in an electron gun apparatus, the method comprising mounting a second grid (40) generally centrally on a first face of an insulating element (50), mounting a first flange (54) of a collar element (55) on a second face of said insulating element (50), said second face of said insulating element (50) being oriented substantially parallel to said first face, mounting a first grid (35) having a grid layer (36) and a cap portion (38) extending substantially perpendicularly therefrom on a second flange (53) of said collar element (55), said second flange (53) being oriented substantially perpendicular to said first flange (54), so that the grid layer (36) of said first grid (35) is substantially parallel to and spaced a distance from a grid surface of said second grid (40).

15. A method as claimed in Claim 14 wherein said second grid (40) and said collar element (55) are mounted on said insulating element (50) by brazing.

16. A method as claimed in Claim 14 or Claim 15 wherein a brazing composition is located between said second grid (40) and said insulating element (50), and said first flange (54) of said collar element (55) and said insulating element (50), and said second grid (40) and said collar element (55) are brazed to said insulating element (50) simultaneously by heating the assembly to brazing temperatures.

17. A method as claimed in any one of Claims 14 to 16 wherein mounting said first grid (35) to said collar element (55) comprises inserting a spacer member (39) through a slot (51) provided in said insulating element (50) adjacent said second grid (40), moving said first grid (35) within said second flange (53) of said collar element (55) toward said second grid (40) until the grid layer (36) of said first grid (35) contacts said spacer member (39) and fixing effecting by mounting said cap portion (38) of said first grid (35) to said second flange (53) of said collar element (55).

18. A method as claimed in any one of Claims 14 to 17 wherein aligned central apertures (41, 37) in said second grid (40) and said grid layer (36) of said first grid (35) are formed after said grids (35, 40) have been mounted relative to one another.

19. A method according to Claim 18 wherein a cathode assembly (45) is mounted along a generally central longitudinal axis of said first grid (35), a terminal portion of said cathode assembly (45) being aligned with said central apertures (37, 41) in said first and second grids (35, 40).

20. An electron gun apparatus comprising a grid assembly as claimed in any one of Claims 1 to 12 together with anode and cathode assemblies mounted in operative relationship therewith.

21. An electon gun apparatus comprising an anode; a cathode; and a grid assembly comprising a first grid (35) having a grid layer (36) and a cap portion (38) extending substantially perpendicularly from the periphery of said grid layer (36), a second grid (40) comprising a grid surface arranged parallel to said grid layer (36) of said first grid (35) and spaced apart relative thereto and securement means fixing the positional relationship between the first grid, the second grid, the anode and the cathode; characterized in that the securement means comprises fixing means (a) and/or (b) defined below:-

(a) fixing means fixing the positional relationship between the first and second grids and comprising:-

(i) an insulating element (50) having first and second faces oriented parallel to one another, said first face being rigidly mounted on said grid surface of said second grid (40); and

(ii) a collar element (55) comprising first and second flanges or faces (54, 53) oriented substantially perpendicular to one another, said first flange or face (54) rigidly mounted on said second face of said insulating element (50) and said second flange or face (53) being rigidly mounted to said cap portion (38) of said first grid (35).

(b) fixing means fixing the positional relationship between the second grid and the anode and comprising:-

an insulating element (60) having first and second faces oriented parallel to one another, said first face being rigidly mounted on a grid surface of said second grid (40); a collar element (65) comprising first and second flanges or faces oriented substantially perpendicular to one another, said first flange or face (64) being rigidly mounted on said second face of said insulating element (60); and an anode (45) having a grid layer (46) and a cap portion (48) extending substantially perpendicularly from the periphery of said grid layer (46), said cap portion (48) of said anode (45) being rigidly mounted to said second flange or face (63) of said collar element (65).

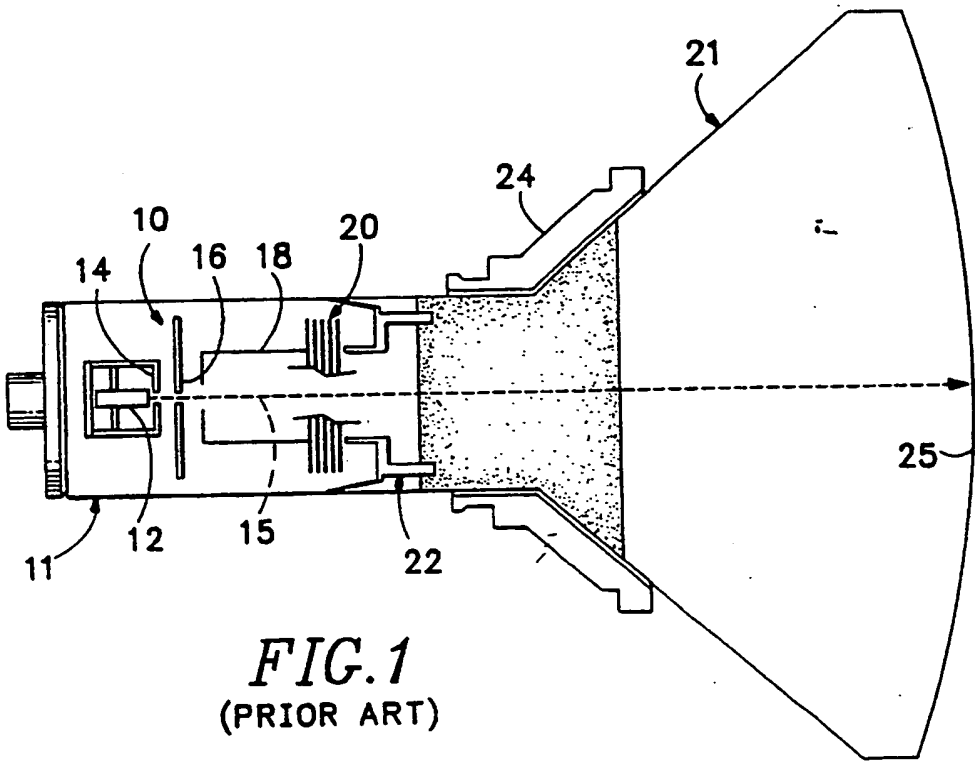

FIG. 1
(PRIOR ART)

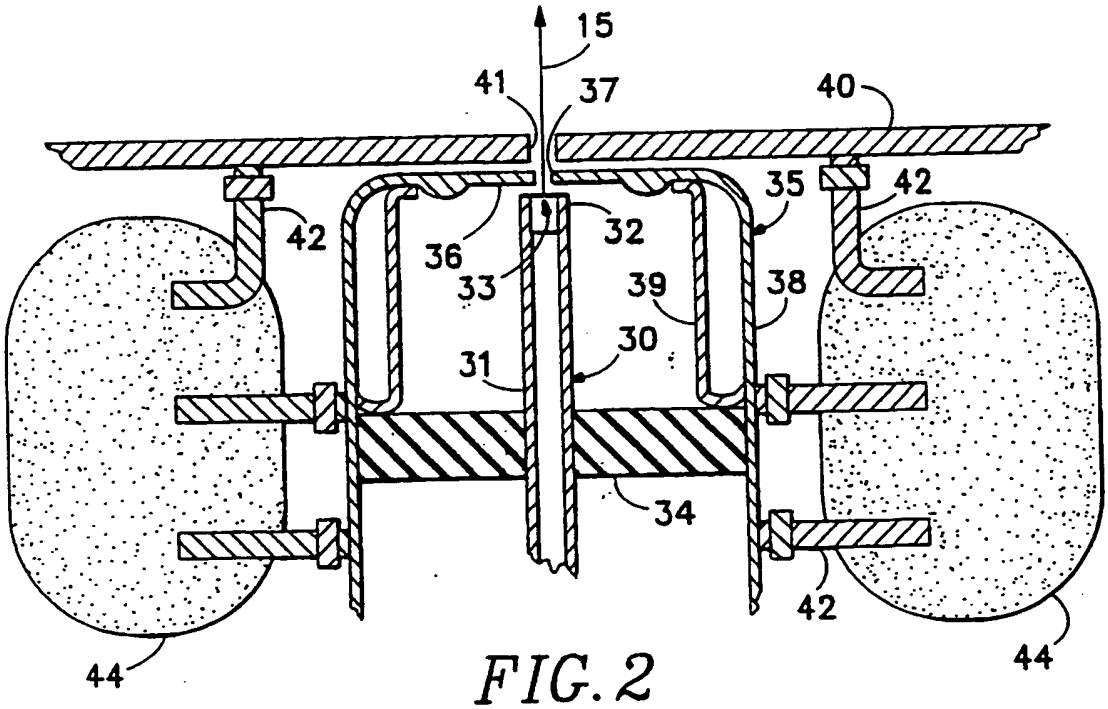

FIG. 2
(PRIOR ART)

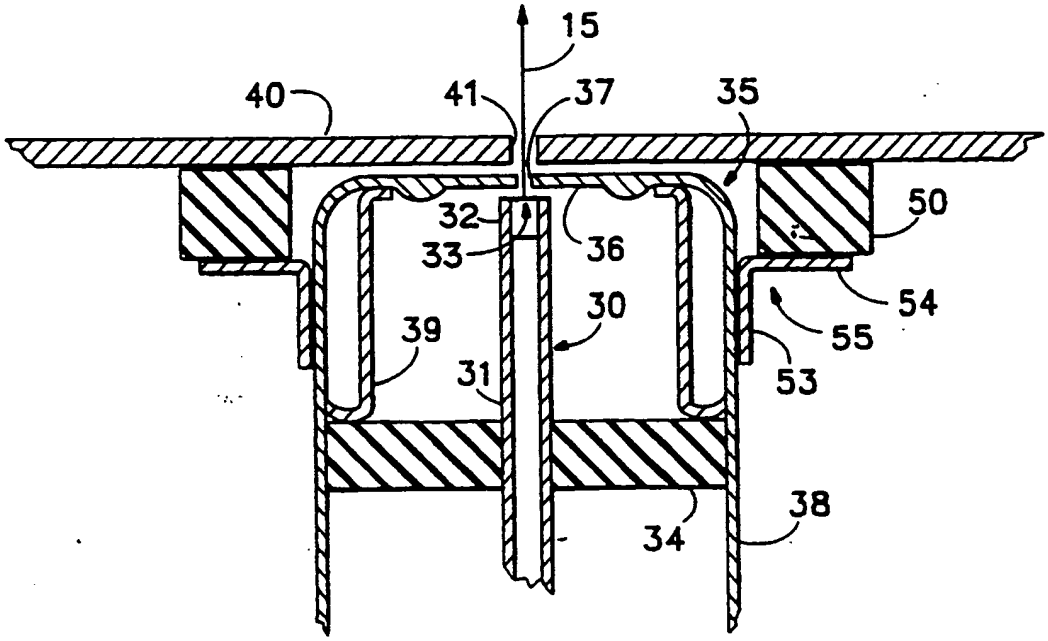

FIG. 3

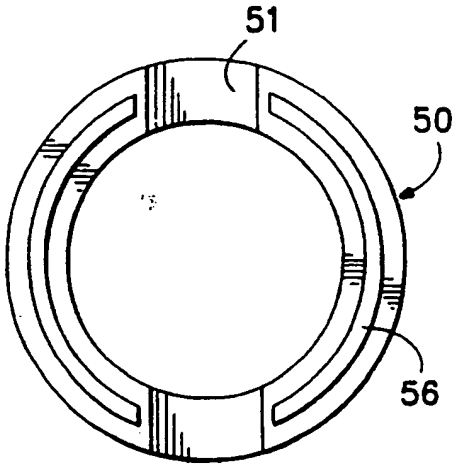

FIG. 4

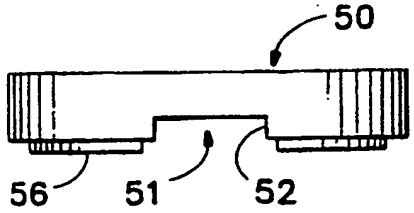

FIG. 5

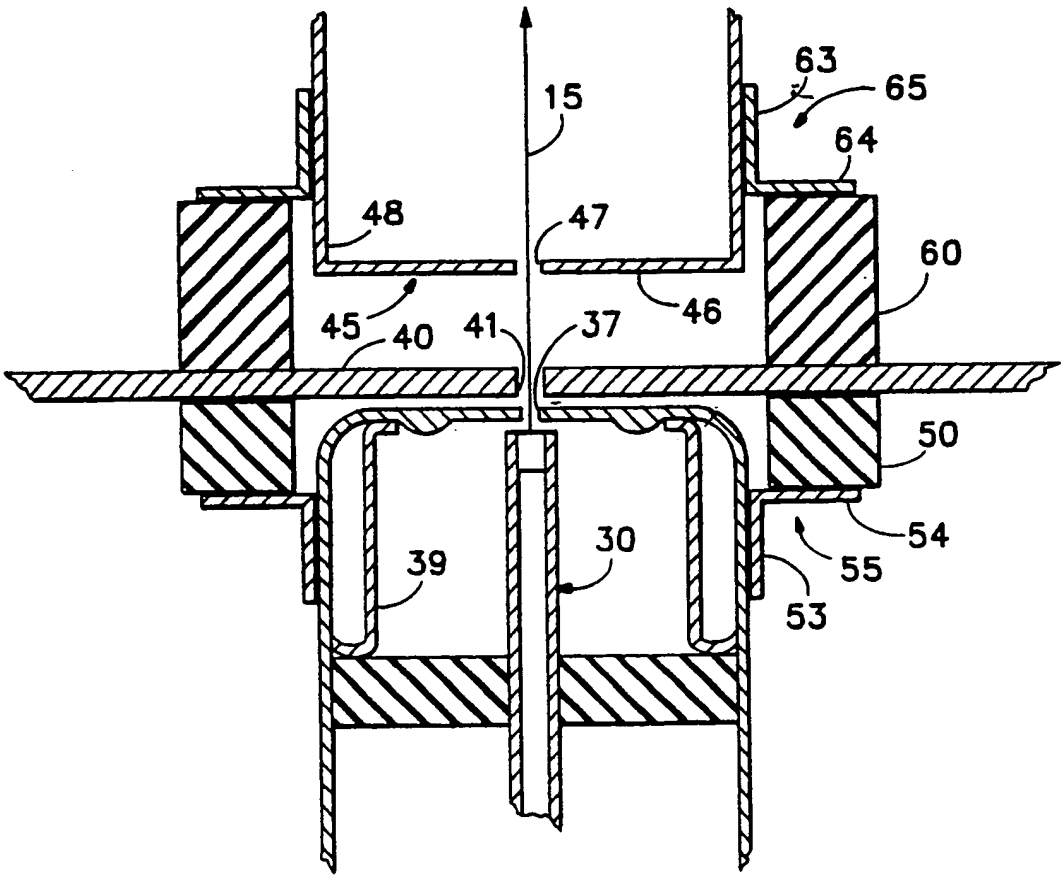

FIG.6

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 415 562 A3**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 90308364.0

(22) Date of filing: 30.07.90

(51) Int. Cl.5: H01J 29/48, H01J 29/82, H01J 9/18

(30) Priority: 31.08.89 US 401208

(43) Date of publication of application:
06.03.91 Bulletin 91/10

(84) Designated Contracting States:
DE FR GB NL

(88) Date of deferred publication of the search report:
23.10.91 Bulletin 91/43

(71) Applicant: TEKTRONIX, INC.
P.O. Box 500 (50-PAT)
Beaverton Oregon 97077-0001(US)

(72) Inventor: Askew, Dennis D.
437 SE 15th Gresham
OR 97080(US)
Inventor: Bomberger, Donald C.
22555 S.W. Boones Ferry Road
Tualatin OR 97062(US)
Inventor: Odenthal, Conrad J.
1308 SE 76th Avenue
Portland, Oregon 97215(US)

(74) Representative: Lawrence, Malcolm Graham et al
Hepworth, Lawrence, Bryer & Bizley Gate House South West Gate
Harlow Essex CM20 1JN(GB)

(54) Grid assemblies for use in cathode ray tube.

(57) An integrated grid (G1/G2) assembly having enhanced mechanical strength and rigidity is provided for use in an electron gun assembly of a cathode ray tube (CRT). In the integrated grid assembly, the first and second grids (35 and 40, respectively) are fixed in relationship to one another, both axially and radially, by means of an insulating element (50) and a collar element (55). Brazed joints are preferably provided at the interface of the insulating element (50) with the second grid (40) and the collar element (55) to enhance the mechanical strength and rigidity of the assembly. An integrated grid (G1/G2)/anode assembly may be provided by mounting anode assembly (45) fixedly with respect to second grid (40) by means of second insulating element (60) and second collar element (6?). Methods for assembling the integrated grid assemblies are also disclosed.

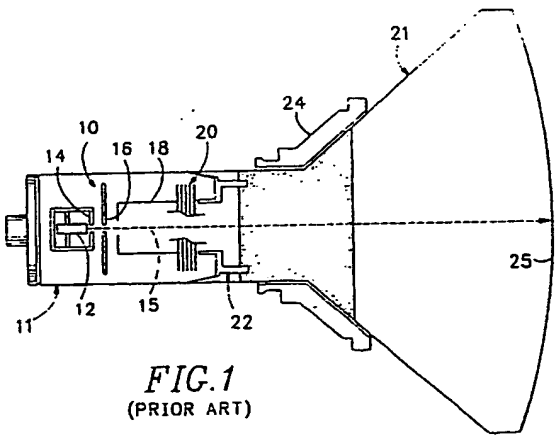

FIG.1
(PRIOR ART)

EP 0 415 562 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 30 8364

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	EP-A-0 234 340 (HEIMANN GmbH) * Abstract; figures; column 1, line 47 - column 2, line 4; claim *	1-13,20, 21	H 01 J 29/48 H 01 J 29/82 H 01 J 9/18
A	DE-A-2 247 018 (SIEMENS AG) * Page 2, paragraph 1; claim 3 *	10,11	
A	US-A-4 629 934 (A.K. WRIGHT) * Abstract; figure 3; column 3, lines 8-10; column 4, line 14 - column 5, line 43 *	10,11, 14-19	
A	US-A-3 004 183 (H.L. LEVIN) * Figures 3,6; column 5, lines 6-53 *	17	
A	H.R. BROOKER et al.: "Industrial Brazing", 1953, pages 21-25,94-95, Iliffe & Sons, London, GB	15	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

H 01 J

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	31 July 91	CLARKE N.S.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
Y: particularly relevant if combined with another document of the same catagory
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention

E: earlier patent document, but published on, or after the filing date
D: document cited in the application
L: document cited for other reasons

&: member of the same patent family, corresponding document